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Corrective Measures Implementation Report
NIROP Sumps
SWMUs N-1, -4, -5, -6, -7, -8 &
HWMU BW-7



1.0 INTRODUCTION

This Corrective Measures Implementation Report (CMIR) has been completed in accordance with Module IV.F.3 of the ATK Launch System Inc. (ATK) Hazardous Waste Storage Permit, for the Bacchus Facility, Plant 1 (the Permit); in conjunction with the ATK RCRA Facility Investigation Work Plan (January 2010). The purpose of the CMIR is to document compliance with the technical and statutory requirements of remedial activities that have taken place during corrective action at seven solid waste management units (SWMUs) and one hazardous waste management unit (HWMU) on the Naval Industrial Reserve Ordnance Plant (NIROP). The SWMUs were earthen sumps used for disposal of process water wastes, the HWMU was a buried waste site comprised primarily of burning ground ash. The background and scope of this corrective action is discussed in the following sections.

1.1 BACKGROUND

The Bacchus Facility of ATK Launch Systems is located southeast of the unincorporated town of Magna, Utah, southwest of Salt Lake City, Utah (Figure 1). The facility began operations in 1915 as a producer of commercial blasting powder, and was transformed in 1958 to a solid-rocket propulsion research, development, and production facility.

The depth to groundwater in the area of the SWMUs is about 180 feet below ground surface; at the HWMU, groundwater is at about 30 feet below ground surface. The stratigraphy is extremely variable with interbedded layers of sand, gravel, silts, and clays throughout the entire section, with nearly no lateral continuity.

A Corrective Measures Implementation Plan (CMIP) was submitted to and approved by the Utah Division of Solid and Hazardous Waste (the Division) for corrective action on 16 SWMUs. The CMIP included 12 SWMUs on ATK's Plant 1 facility and 4 SWMUs on NIROP. During implementation of the CMIP in September 2012, access to the four NIROP SWMUs in the HMX production area (N-4, 5, 6, & 7) was restricted. Therefore, with approval



from the Division, corrective measure implementation and reporting on the four remaining units was delayed until the spring of 2013. Based on proximity to the four remaining HMX sumps, ATK requested that three additional sumps (N-1, 2, & 8) located on the NIROP property be included in the corrective action.

In August 2012, ATK submitted a RCRA Facility Investigation Report on four SWMUs in priority Group 4a. In this report ATK documented that HWMU BW-7 would require additional corrective action; therefore, ATK requested that BW-7 also be included. A supplemental CMIP was submitted and approved by the Division that included the four additional units.

Corrective action was conducted on the eight SWMUs mentioned in the previous paragraphs in April and May 2013. The subsequent analytical results from the confirmation sampling indicated that all but one unit (N-1) would require additional soil removal. A letter was sent to the Division requesting that additional soil removal be conducted during the next round of corrective action. The locations of the SWMUs are presented on Figure 2.

1.2 PURPOSE AND SCOPE

The corrective measure at the SWMUs discussed in Section 1.1 was implemented as described in the Corrective Measure Implementation Plan (CMIP) dated June 2010. The corrective measure to excavate and transport contaminated soils to an approved landfill was selected. Corrective action would remove contaminants of potential concern (COPC) to levels at or less than concentrations necessary to close the site under a residential scenario.

The additional corrective action was conducted in June of 2014. Addition soil was removed from SWMUs N-2, N-4, N-5, N-6, N-7, N-8, and BW-7. Samples were collected from the excavations to confirm adequate soil was removed to meet the corrective action objectives. Samples were also collected from the transported soils to confirm requirements for disposal at the Salt Lake County landfill were met. This CMIR includes the data and information necessary to request a No Further Action (NFA) determination for future



residential/unrestricted use as presented in UAC 315-101. This corrective measure meets the corrective action objectives, to be discussed in the following section, of protecting human health and the environment by eliminating surficial and shallow subsurface contaminated soil.



2.0 CORRECTIVE ACTION OBJECTIVES

Corrective action objectives (CAOs) were developed in the CMIP to address potential risks to human health and the environment. The CAOs are listed in the bullets below.

- Removal of contaminated soil, as needed, to meet a residential or no further action (NFA) land-use exposure scenario as defined in R315-101 of the Utah Administrative Code.
- Removal of soil as needed to prevent potential migration of contamination to groundwater as described in R315-101-3 of the Utah Administrative Code.

Potential risks to human health were estimated based on a residential land use scenario. The potential receptors associated with this land use are ATK employees, construction workers, and future residential landowners and developers.

2.1 CONTAMINANTS OF CONCERN

COPCs were determined for each individual SWMU. This determination was based on the results of the RFI, confirmation samples collected during the first round of corrective action, and/or process knowledge and information contained in the RCRA Facility Assessment report approved by the DSHW in 1989. COPCs included as part of this CMIR include RCRA metals, energetics (nitroglycerin (NG), HMX, RDX, and perchlorate), and dioxin/furans. Not all analytes were considered a COPC at all SWMUs.

2.2 POTENTIAL RISK TO HUMAN HEALTH

The risk-based cleanup criteria were selected based on the Residential Regional Screening Level as published in the “Regional Screening Levels for Contaminants of Concern at Superfund Sites, January 2015,” generated by the U.S. Environmental Protection Agency, Region 9. The soil analytical results were evaluated using these screening levels for a residential scenario and potential migration to groundwater, and consumption of homegrown produce.



2.3 MEDIA CLEANUP STANDARDS

Media cleanup standards are media- and chemical-specific concentrations that a corrective measure must achieve to meet the corrective action objectives. The media cleanup standards were based on the site-specific media of concern, identified contaminants of potential concern, exposure routes and receptors, and identification of acceptable concentrations for each exposure route. The published cleanup standards for the COPCs are presented in Table 1.

For the potential migration to groundwater, the dilution attenuation factor (DAF) was arrived at using “*Appendix E, Determination of Ground Water Dilution Attenuation Factors, EPA Office of Solid Waste, May 11, 1994.*” This document has been referred to many times by the Division when a migration to ground water concern may exist. Areas of excavation at the NIROP SWMUs ranged from 200 sq.ft. at N-8 to 780 sq.ft. at N-4; the three decision units (DUs) at BW-7 ranged from 2000 sq.ft. to 5400 sq.ft. Section 4.3 of the document (DAF Values as a Function of Source Area), presenting the 95th percentile for the Default Nationwide Scenario, was used. The graph presented as Figure 6 in the EPA document does not project DAF values for areas less than 1000 sq.ft. The DAF for SWMUs less than 1000 sq.ft. was therefore interpolated to be 4000. The DAFs for the DUs at BW-7 ranged from 650 to 1700. Ground water protection cleanup standards, including DAFs, are shown on Table 2.

2.4 SELECTION OF CORRECTIVE ACTION

Corrective measure technologies were evaluated based on their ability to effectively address the elevated concentrations of metals, energetics, and dioxin in the soil and achieve cleanup standards. Based on the conceptual model of the contaminated soil and its presumed historical appearance, the only corrective measure technology applicable to achieve a residential closure under R315-101, and receive a No Further Action decision, was soil removal and off-site disposal.



2.5 COMPLIANCE WITH CLEANUP STANDARDS

Completion of corrective measures for the soil media ~~is~~was documented by comparing the confirmation sample concentrations of COPCs in the soil to the required media cleanup standards. The Exposure Point Concentration (EPC) value used for these comparisons was the average concentration value of the samples collected at the unit. Because of the minimal area of the excavated footprint at each SWMU, an adequate number of samples to calculate a 95% upper confidence limit were not practical. ~~If the maximum analyte concentration was less than the media cleanup standard the corrective measure was considered complete.~~ Additional excavation and sampling was conducted at SWMUs where the EPC was greater than the media cleanup standard. Incremental Sampling Methodology (ISM) was used for confirmation sample collection and analyses following the second round of corrective action. The ISM value was compared to the media cleanup standard to evaluate completion of corrective measures.



3.0 CORRECTIVE MEASURE ACTIVITIES

This section provides the details of the corrective measures conducted at the waste management units discussed in this report.

3.1 CORRECTIVE ACTION METHODOLOGY

The corrective action methodology consisted of excavating soils at each SWMU where COPCs were expected to exceed their RSLs, and off-site disposal at a Salt Lake County Landfill. The receiving landfill is constructed with a liner and leachate collection system, and permitted to receive the material excavated during this corrective action. Use of the Salt Lake County Landfill for disposal of the excavated waste was approved by the Division, based on analytical data supplied to the landfill operator. Excavation and transportation activities were conducted by Veolia Environmental Services (VES) under the direction of ATK. References to the excavation and disposal of soils from the SWMUs will refer to all SWMUs involved in the corrective action.

3.1.1 Excavation

The general boundary for each SWMU was established during the RFI. No documentation has been identified to raise concerns that the sumps or conveyance troughs overflowed. Discharge to the sumps was conducted in batch operations that were significantly less than the capacity of the sump. All of the sumps had potential for lead contamination. An XRF was used to evaluate lead concentrations along the traces of the troughs to screen for potential contamination. No lead values were significant enough to include the trough line in the corrective action process. The CMIP stated that eCorrective action ~~would~~ continued until soil concentrations of the COPCs were less than the RSL cleanup standards.

Prior to beginning activities, all necessary onsite permits were obtained and underground utilities located. VES mobilized the necessary equipment to conduct the corrective action activities. Equipment used included an excavator, front-end loader, water trucks, and 18-yard sift-free boxes to be loaded and hauled by trucks. The sift-free boxes were



required under the special waste permit granted by the United States Department of Transportation. The special permit was required because of detectable concentrations of HMX.

Soils were excavated and placed either directly into the boxes for transport and disposal or staged next to the individual unit. During excavation, the soil was sprayed with water to mitigate potential dust emissions. Excavation continued until material that exceeded the approved cleanup standard was thought to have been removed. During excavation, qualitative analysis for the COPC metals was conducted using a hand-held X-ray fluorescence (XRF) spectrometer. The XRF allows for field analysis of in-situ and grab soil samples. Site experience has indicated that the XRF tends to report metals concentration at levels slightly more conservative (greater concentration) than quantitative laboratory analysis. The XRF was used to direct the operator where to excavate and when to cease excavation. Photos of the excavation areas are presented in Attachment A.

3.1.2 Transportation and Disposal

Each box was loaded with approximately 14 tons of soil. Over the course of both corrective action events, 17~~5~~⁴ truckloads (2443 tons) were loaded and transported to the landfill. The boxes were sealed and transported, accompanied by a bill-of-lading, which included the origin of the waste soil, its final disposal location, and date of transport. Copies of the bills-of-lading are included in Attachment B.

3.2 SAMPLING ACTIVITIES

Confirmation sampling consisted of screening the exposed areas of the excavation with the XRF for metal analytes and collection of soil samples for quantitative analysis to confirm that the CAOs were achieved. Confirmation analyses were conducted for volatile organics, RCRA metals, energetic compounds, or dioxin/furans, depending on process knowledge of waste streams discharged to or disposed at, each individual unit. Samples were also collected from



the soils loaded into the transport boxes to confirm that disposal requirements for the landfill were met. The following sections discuss the process of sample collection.

3.2.1 XRF Soil Screening

Once excavation activities were thought to be complete, the excavation area was visually inspected for signs of contamination. HMX contamination can appear as a white, powdery material; however, HMX cannot be qualitatively tested for in the field. If necessary, additional soil was removed until the field engineer made a determination that the likelihood of HMX contamination, based on visual observation, was no longer present. The exposed soils were then qualitatively evaluated for metals using the XRF. The areas evaluated included the bottom and side-walls of the excavation, along with random buckets of soil placed in the transport boxes. In areas where the XRF indicated elevated metal concentrations, additional soil was removed and reevaluated.

3.2.2 Confirmation Sample Collection

Discrete samples were collected from the bottoms and side-walls of the excavated units during the first corrective action event. Analytical results indicated that additional soil needed to be removed to meet the CAOs, primarily for HMX/RDX, which cannot be qualitatively screened in the field. The modified CMIP for the second round of soil removal divided each sump into decision units (DU) for the side-walls and excavation bottom, and used Incremental Sampling Methodology (ISM) for sample collection. Each event is discussed in the following sections.

3.2.2.1 Discrete Sample Collection

Confirmation samples were collected according to the approved/modified CMIP. Subsequent to the first excavation activity, the confirmation sample locations were randomly spaced over the excavation floor. The excavations were visually evaluated for areas of staining or other indicators of contamination. The locations of the confirmation samples were discussed with and agreed to by Division personnel. One sample was always positioned in the approximate location of the historic outfall into the sump. Discrete samples of the side-walls were



randomly selected from around the sump excavation, and in cases of a small sump, the samples were composited. The confirmation soil samples were collected manually, generally from zero to 6 inches deep. Samples were screened with a 10-mesh sieve to remove the larger fractions of pebbles and concentrate the fines. This tends to produce a slightly more conservative analytical result (higher reported concentration). The final excavations and sample locations were not surveyed in by a professional land surveyor. Sample locations were recorded using a standard GPS meter.

3.2.2.2 ISM Sample Collection

Following the second soil removal event, each SWMU was divided into two DUs; typically, the side-walls (DU-1) and the excavation bottom (DU-2). Each DU was divided into 30 areas of approximately the same size, as per typical ISM protocol. An increment of soil was collected from within each area of approximately the same volume/mass and placed in a clean 5-gallon bucket. The composite of collected soils was then transferred to a large sealable, plastic bag for delivery to the laboratory. Each increment was collected according to the SOP submitted to the Division. The total composite of the 30 increments was sent to the testing laboratory for processing and analyses. ISM was only used on samples that required metals or energetic analyses. The resulting ISM value is then applied to the entire DU. The SOP used for the DU sampling is included as Attachment C.

3.2.2.3 Sample Handling

Sample containers were labeled with the date and given a unique identification number. The primary analytical services were provided by ATK Launch Systems, Analytical Chemistry Laboratory, certified by the State of Utah for the analytes required under the CMIP. The samples were analyzed for the constituents shown in Table 3.

Soil samples were placed in containers consisting of new glass jars, with Teflon-lined lids. Only stainless-steel equipment or disposable nitrile gloves contacted the samples during



placement into the jars. Disposable gloves were worn at all times during sample handling to prevent possible cross-contamination. Gloves were disposed of between each sample location.

Sample jars were placed in resealable plastic bags to provide protection from other samples and sample handlers in the event of sample-container breakage. Sample labels were used to identify the samples and were sufficiently durable to remain legible if wet and were marked with indelible ink and affixed to the sample containers. Sample jars were placed on ice, in waterproof chests, for delivery to the analytical laboratories.

A chain-of-custody form was completed to track sample possession from the time of collection through laboratory analysis. One chain-of-custody form accompanied each shipping container of samples. The required analyses were indicated on the chain-of-custody form, including the quantity and types of containers that comprised each sample. The completed chain-of-custody form was sealed in a plastic bag and placed inside the shipping container. The shipping container was then securely closed and delivered to the analytical laboratory. Copies of the chain-of-custody forms are included with the analytical reports in Attachment D.

3.2.3 Excavated Soil Sample Collection

Samples from the excavated soils were collected at a frequency of about one sample for every 100 cubic yards (CY) of soil removed for disposal. Twenty samples were collected and analyzed for RCRA metals, TCLP RCRA metals, and energetics over the two excavation events. Each sample was a composite of at least four locations within the box or within the staging pile.

Where soils were staged, approximately 12 inches of additional soil beneath each staging pile was removed. This area was considered part of the excavation when confirmation soil sampling was conducted.

Samples were collected using the same methodology as the confirmation samples in Section 3.2.2. Analytical reports are included in Attachment D.





4.0 CONFIRMATION SAMPLE RESULTS

Soil samples were analyzed for the list of constituents presented in Table 3. Data collected during this investigation were evaluated for the contaminants of potential concern (COPCs) using the “Regional Screening Levels for Contaminants of Concern at Superfund Sites,” ~~January-June~~ 2015, used by the U.S. Environmental Protection Agency. The Regional Screening Levels (RSLs) for a residential land-use scenario were used to screen the data for potential risk to human health. Each SWMU was evaluated individually. Because of the limited size of each SWMU, there were not enough confirmation samples at each unit to calculate a 95% upper confidence limit for each analyte. The ~~maximum-average~~ concentration was therefore used as the EPC and compared to the RSL. Where ISM results were reported, the ISM value was used as the EPC for the specific DU. All data is reported as dry weight equivalents. The ISM samples were designate with either an “a” or “b”, based on whether the sample was collected from the side-wall or bottom of the excavation, respectively. SWMU N-1 was small enough that it was considered one DU. HWMU BW-7 was originally divided into five DUs (Figure 3). For the second round of sampling for dioxin, DU-2 and DU-3 were combined for ISM sampling. Analytical reports are included in Attachment D.

4.1 CONFIRMATION SAMPLES

The following sections discuss the results of the samples-of-record collected from the excavation events, discrete and ISM.

4.1.1 Metals – Confirmation Sample Results

Confirmation samples were collected within the area of excavation to document completion of the corrective action and compliance with the CAOs. During the initial excavation event, 63 discrete samples were collected for metals and energetic analyses. Thirteen additional ISM samples were collected during the second excavation event. A summary of the confirmation sample results for COPC metals is shown in Table 4.



Ten metals (antimony, beryllium, cadmium, chromium, copper, lead, nickel, silver, zinc, and mercury) reported concentrations greater than the method detection limit (MDL) in at least one sample. There were no detectable concentrations reported for arsenic, selenium, or thallium from the initial confirmation samples. ISM results from the second excavation event did report low concentrations of arsenic and silver at two units. During the first sampling event, lead at SWMU N-7 was the only metal reported at concentrations greater than the respective RSL (400 mg/kg). Although lead concentrations at SWMU N-5 did not exceed the RSL, three samples exceeded 300 mg/kg. SWMUs N-5 and N-7 were selected for additional soil removal. The second excavation event brought the lead concentrations at N-5 down from a high of 338 mg/kg to 15.7 mg/kg, and at N-7, from a high of 555 mg/kg down to 73.8 mg/kg.

4.1.2 Energetics – Confirmation Sample Results

HMX was the only energetic constituent reported in every sample collected during the first sampling event (see Table 4). The maximum concentration of HMX was reported at SWMU N-5, at a concentration of 15,400 mg/kg. SWMUs N-6 also reported a concentration greater than the RSL (5580 mg/kg). The residential RSL for HMX is 3800 mg/kg. Although less than the RSL, HMX concentrations at SWMUs N-4 and N-8 were reported near the RSL (2350 mg/kg and 3490 mg/kg, respectively). These four units were selected for additional soil removal.

Following the second excavation event, the residual HMX concentrations were reduced as follows: N-4 reduced to 68 mg/kg, N-5 reduced to 160 mg/kg, N-6 reduced to 96 mg/kg, and N-8 reduced to 100 mg/kg. The respective maximum HMX concentration for each SWMU is less than the respective RSL and GWP value.

RDX was reported at concentrations greater than the RSL at SWMU N-2 (a high of 36.7 mg/kg); the RSL is 6 mg/kg. N-2 was therefore selected for additional soil removal. Following the second excavation event, the RDX concentration was still greater than the RSL. The ISM concentrations for RDX were reported to be 16 mg/kg (bottom) and 20 mg/kg (sidewalls). Since additional soil removal will be required to achieve CAOs, N-2 is no longer



discussed in this CMIR. RDX was reported in the side-wall sample of N-5 at a concentration of 0.27 mg/kg. The sample collected from the bottom of the N-5 excavation did not report RDX greater than the method detection limit (MDL). The MDL for RDX is 0.20 mg/kg. HMX and RDX concentrations at each SWMU are less than the respective RSL and GWP. Figure 4 shows the locations of monitoring wells down gradient. RDX has not been historically reported in these wells.

Perchlorate was only identified in samples collected at HWMU BW-7 (8 of 25 samples). The maximum concentration was 6.83 mg/kg. The RSL is 55 mg/kg. The USEPA has not established a soil-to-groundwater protection value for perchlorate. ISM sampling for the second sampling event reported concentrations of 3.2 mg/kg, 0.87 mg/kg, and 0.29 mg/kg at each of the DUs. Figure 5 shows the location of monitoring wells in the near vicinity of BW-7. Perchlorate has been reported in all of the wells shown. Monitoring wells up gradient from BW-7 have historically reported both perchlorate and HMX at concentrations greater than those reported down gradient from BW-7.

4.1.3 Dioxin – Confirmation Sample Results

Dioxin was only analyzed from the soils at HWMU BW-7. Rather than discrete samples, BW-7 was initially divided into five DUs (see Figure 3). A composite was collected from each DU for analysis. Three of the DUs reported TEQ values greater than the RSL of 4.9 ng/kg. BW-7 was selected for additional soil removal in those DU areas (1, 2, and 3). Additional soil was excavated from the areas reporting the elevated dioxin TEQs.

Following the second soil removal event, the three areas reporting the presence of dioxin were divided into two DUs (combining 2 and 3), and sampled according to the SOP. The ISM results reported a drop in the dioxin TEQ from 26.6 ng/kg in DU-1 to 3.95 ng/kg, and from 6.59 ng/kg to 0.661 ng/kg in the combined area of DU-2 and 3.

4.1.4 Volatile Organics – Confirmation Sample Results



Based on process knowledge, volatile organics were only analyzed on soil samples from N-1 and BW-7. The only organic compound reported was dichlorodifluoromethane, at 0.028J mg/kg and 0.025 mg/kg, respectively. The RSL value is 87 mg/kg.

4.2 EXCAVATED SOIL SAMPLES

Soil samples from the excavated soils were analyzed for RCRA metals, RCRA TCLP metals, and energetics. Composite samples were collected from the transport boxes or staging pile to evaluate the material that was sent off-site for disposal. A scatterplot of total lead concentrations versus TCLP lead results had been developed from extensive data to calculate a 95% Prediction Interval. A similar chart has also been developed to compare the total lead concentration results to the qualitative XRF field results. Using this data, ATK was able to predict the possible TCLP leachate concentration based on the XRF results obtained in the field. This information was used to make a field decision on whether or not the soil would meet the landfill criteria for a non-characteristic hazardous waste (based on lead concentrations).

The laboratory results for total lead concentrations for the excavated soils ranged from non-detectable to 3890 mg/kg. The TCLP extract concentrations for lead ranged from non-detectable to a maximum of 1.64 mg/L. The regulatory level is 5 mg/L.

4.3 CONFIRMATION SAMPLE RESULT SUMMARY

As discussed in Section 4.1, except for HMX results at N-2, the maximum concentrations for all COPCs evaluated under this corrective action are less than both the RSL for a residential scenario and the Groundwater Protection Level using the respective DAF for the area of each SWMU. The results indicate that corrective measures satisfied the required media cleanup standards and CAOs.

4.4 QUALITY CONTROL

Seven duplicate samples were collected during the first excavation event. Duplicate analyses included metals and energetics. Two additional duplicates were collected following the second



excavation event. Dioxin was included to the list of analytes for duplicates collected from BW-7. No volatile organic compounds were considered COPCs for the purpose of this CMIR, and only dedicated sample collection equipment was used. Therefore, only duplicate soil samples were collected for field quality control. No equipment blanks were collected.

A summary of the samples with detected metals in either or both the sample-of-record and corresponding duplicate sample are shown in Table 5, along with the relative percent deviation (RPD) value. RPDs ranged from 0.0% to 62.5%. Only two of the 68 comparisons (3%) calculated a RPD greater than 25%. These were low concentration values, which can be expected to have a larger RPD range.



5.0 RISK EVALUATION

The following sections discuss the evaluations of human and ecological risk assessments.

Arsenic was not detected at concentrations greater than the MDL (~2 mg/kg) during the initial sampling event. However, arsenic was detected in two of the second event samples at a maximum concentration of 12.8 mg/kg. The background threshold value (BTV) for arsenic at the Bacchus facility has been calculated to be 9.98 mg/kg. Concentrations of naturally occurring arsenic across the Bacchus facility have been reported as great as 30 mg/kg. Silver was also reported in two samples from the second sampling event, with a maximum concentration of 0.07 mg/kg. The BTV for silver has been calculated to be 0.446 mg/kg. A list of BTVs for metals and dioxin are shown in Table 6. Selections of the COPCs (discussed in Section 2.1) were based on analyte concentrations that reasonably exceeded the BTV for the Bacchus facility, regardless of whether the RSL or GWP value was exceeded. The analytes considered COPCs for this study are cadmium, copper, lead, mercury, zinc, HMX, RDX, perchlorate, dioxin/furan, and dichlorodifluoromethane.

5.1 HUMAN HEALTH RISK EVALUTION

The principle activity associated with corrective action was the excavation of eight SWMUs associated with this CMIR and off-site disposal. The HHRA was evaluated using the Risk Assessment Information System (RAIS) Contaminated Media (Risk) Calculator, developed by the Oak Ridge National Laboratory, sponsored by the US Department of Energy. The RAIS Calculator is located at www.rais.ornl.gov.

5.1.1 HHRA

Based on the published RSL and GWP values (Tables 1 and 2), and the general immobility of the identified constituents, migration to groundwater (which is generally around 180 feet below the current excavation surfaces) would be highly unlikely, and unable to accumulate at concentrations that would be of adverse effect on human health or the environment. The soil to



groundwater pathway poses no concern for dermal contact and/or ingestion and is protective of human health.

The analytes identified as COPCs at each specific SWMU/HWMU were entered into the RAIS Calculator, and evaluated for the HHRA. Lead was not included in the RAIS evaluation, and is discussed in the next paragraph. The results indicate that the measureable resident risk for soil at each unit is less than 1.0×10^{-6} , and the Adjusted Total Hazard Index was calculated to be less than 1.0. The RAIS output for these values is summarized in Table 7 and included in Attachment E.

EPA has no consensus RfD (reference dose) or CSF (carcinogenic slope factor) for inorganic lead, so it is not possible to calculate screening levels, as can be done for other the other analytes. EPA considers lead to be a special case because of the difficulty in identifying the classic "threshold" needed to develop an RfD. EPA therefore evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK). The EPA Office of Solid Waste has also released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 mg/kg are generally safe for residential use. Above that level, the document suggests collecting data and modeling blood-lead levels with the IEUBK model. For the purposes of screening, therefore, 400 mg/kg is recommended for residential soils. The greatest concentration of lead reported was 139 mg/kg, in the side-wall sample at SWMU N-6.

5.1.2 Homegrown Produce Evaluation

Residential consumption of homegrown produce was evaluated. The evaluation assumed a 15% consumption of produce being homegrown, using a combined fruit/vegetable consumption of 84,700 mg/day for an adult and 25,200 mg/day for a child.

Each SWMU/HWMU, except for N-1, was divided into decision units (DUs). DUs for the HMX sumps included the side-walls of the excavation and the excavation bottom (designated as "a" and "b", respectively). BW-7 was divided into three DUs, for reasons



discussed earlier. Fourteen DUs were evaluated for risk that could be associated with homegrown produce. A summary of the Produce Ingestion Hazard Index/Quotient (HI/HQ) and Total Risk are shown on Table 8. The RAIS reports are included in Attachment E.

Three DUs at the HMX sumps showed an HI greater than 1; N-5a (1.39), N-5b (1.03), and N-8a (1.14). Each HI value is driven by the HQ of the HMX concentration; 160, 120, and 100 mg/kg, respectively. To attain a non-carcinogen HQ less than 1, the HMX concentration would need to be reduced to less than 100 mg/kg (38 times less than the RSL). HMX has a RSL of 3800 mg/kg. The RDX concentration at N-5a (0.27 mg/kg) produced a risk value of 3.19×10^{-6} .

HWMU BW-7 was part of the second corrective action because dioxin/furan TEQs exceeded the RSL. Current results indicate an ingestion risk from produce of 8.6×10^{-6} and 1.44×10^{-6} , for DU-1 and DU-2, respectively. A Produce Ingestion HI of 1.40 is calculated at DU-1.

All of the HI and risk based calculations are based on consuming 15% of fruits and vegetables from a homegrown source. Discussions with EPA Region 8 and the Natural Resources Conservation Service in Salt Lake City, Utah, indicated that between one and two acres of producible land is required for a self-subsistence scenario. For a residential homegrown scenario, the type and quantity of vegetables and fruit must be established, as well as the soil quality, soil enhancements, root depths, and actual available land. Using one and a half acres for self-subsistence (65,340 sq.ft.), a consumption of 15% would require about 9800 sq.ft. The square footages for the units exceeding the risk values at N-5 and N-8 are only 700 (1%) and 200 (0.3%) sq.ft., respectively. It would be extremely difficult to grow, preserve, and consume enough of the right produce to reach these risk levels. It would also require that the produce be grown in the exact location of the excavated unit.

HWMU BW-7 has a similar situation with an HI of 1.40 (DU-1) and risk levels of 8.6×10^{-6} and (DU-1) and 1.44×10^{-6} (DU-2). The square footage of these DUs are 2000 (3%) and



3000 (4.6%). Looking at a proportional value of self-subsistence to actual unit size would put the risk values at 2.6×10^{-7} and 6.6×10^{-8} .

Section 5.1.1 presented the human health residential screening level (RSL) for lead to be 400 mg/kg. However, inputting a lead soil concentration into the RAIS Calculator for homegrown produce requires that lead be reduced in the soil to as low as 11 mg/kg to achieve a 1×10^{-6} risk level. This concentration approximates facility background concentrations.

5.2 ECOLOGICAL RISK ASSESSMENT

The “Ecological Risk Assessment Guidance for Superfund, (ERAGS, 2009) addresses five issues to develop a conceptual model. The screening criteria are evaluated to determine whether the ecological risks are negligible, or if the process should continue. The issues to be addressed are:

1. Environmental setting and contaminants known or suspected to exist at the site.
2. Contaminant fate and transport mechanisms that might exist at the site.
3. Mechanisms of ecotoxicity associated with contaminants.
4. Complete exposure pathways that might exist at the site.
5. Selection of endpoint to screen for ecological risk.

The screening criteria were evaluated using known and collected data to assess whether a possible risk to the ecological environment could be present. The following sections summarize each of the potential issues above.

5.2.1 Environmental Setting

The SWMUs are located on industrial property and is anticipated to be industrial for years to come. In the distant future, there is potential for the property to become residential pending RCRA closure of the entire facility.

5.2.2 Contaminant Fate and Transport

The confirmation soil samples indicated that corrective action has met the media cleanup goals as presented in the CMIP. Vertical migration of contaminants through precipitation is the only potential transport mechanism. The COPCs (lead and HMX) are highly immobile and the source of further migration has been removed. The reduction in soil concentration of COPCs demonstrates that migration to groundwater will not occur or cause a potential risk.

5.2.3 Potential Receptors and Ecotoxicity

The SWMUs are located on the NIROP facility, where access by animals that live or forage onsite is not restricted. The potential contaminants of concern have absorption pathways via oral ingestion or inhalation. Although no COPCs pose a threat to human health, lead has been used for the purpose of ecotoxicity in this evaluation. There are no ecological risk values for HMX at this time. Site knowledge suggests that avian ingestion of soil invertebrates and grazing by deer on terrestrial plants would be the most probable receptors. The document titled “Ecological Soil Screening for Lead, Interim Final, OSWER Directive 9285.7-70, and March 2005” (the Directives) was used in this evaluation.

Section 1.0 of the Directives states:

“Ecological Soil Screening Levels (Eco-SSLs) are concentrations of contaminants in soil that are protective of ecological receptors that commonly come into contact with and/or consume biota that live in or on soil. Eco-SSLs are derived separately for four groups of ecological receptors: plants, soil invertebrates, birds, and mammals. As such, these values are presumed to provide adequate protection of terrestrial ecosystems. Eco-SSLs are derived to be protective of the conservative end of the exposure and effects species distribution, and are intended to be applied at the screening stage of an ecological risk assessment. These screening levels should be used to identify the contaminants of potential concern (COPCs) that require further evaluation in the site-specific baseline ecological risk assessment that is completed according to specific guidance (U.S. EPA, 1997, 1998, and 1999). *The Eco-SSLs are not designed to be*

used as cleanup levels and the United States Environmental Protection Agency (EPA) emphasizes that it would be inappropriate to adopt or modify the intended use of these Eco-SSLs as national cleanup standards.” [italics added].

The Eco-SSLs are calculated to achieve a hazard quotient (HQ) equal to 1. The Eco-SSL for lead for birds and mammals, respectively is, 11 mg/kg and 56 mg/kg (insectivores), 46 mg/kg and 1200 mg/kg (herbivores), and 510 mg/kg and 460 mg/kg (carnivores). The lead Eco-SSL for mammals is higher than the 95th percentiles of reported background concentrations for western U.S. soils; however, for avian wildlife the Eco-SSL is lower than the 50th percentile. The average concentration for lead in this study is 68 mg/kg.

The values above indicate a potential risk only to the avian insectivores. However, these values are less than national background concentrations as well as the Bacchus facility.

5.2.4 Exposure Pathways

EPA guidance states, “only complete exposure pathways should be evaluated.” For an exposure pathway to be complete, a contaminant must be able to travel from the source to ecological receptors and be taken up by the receptor via one or more exposure routes. As mentioned in Section 5.2.3, ingestion and inhalation are the most likely exposure routes. Limited exposure levels are present for ingestion by terrestrial animals, and the lack of transport of contaminants mitigate exposure pathways and exposure routes. A complete exposure pathway does not exist and the contaminants do not pose a significant risk.

5.2.5 Selection of Endpoints

Based on the site data, there do not appear to be any adverse effects on potential ecological receptors. Therefore, there are no assessed or measureable endpoints to be drawn from this ecological risk screening.



5.3 SUMMARY

A complete summary of risk includes an evaluation of human health risk consisting of dermal, ingestion, and inhalation contacts with the remaining soils, indoor air quality, and potential ecological impact. Based on the information generated from the criteria used to screen the confirmation sample results additional human health risk and/or ecological risk evaluations are not necessary. The ecological risks are negligible and therefore no need for additional remediation or controls are necessary based on ecological risk. ATK petitions the DSHW for a waiver of any additional ecological risk assessment activities and a no further action

(NFA)/unrestricted use determination under UAC R315-101 relative to the soils at ~~the~~ SWMUs N-1, N-4, N-5, N-6, N-7, and N-8, and HWMU BW-7. ~~located on the ATK property at the Bacchus facility under UAC R315-101.~~



Figures

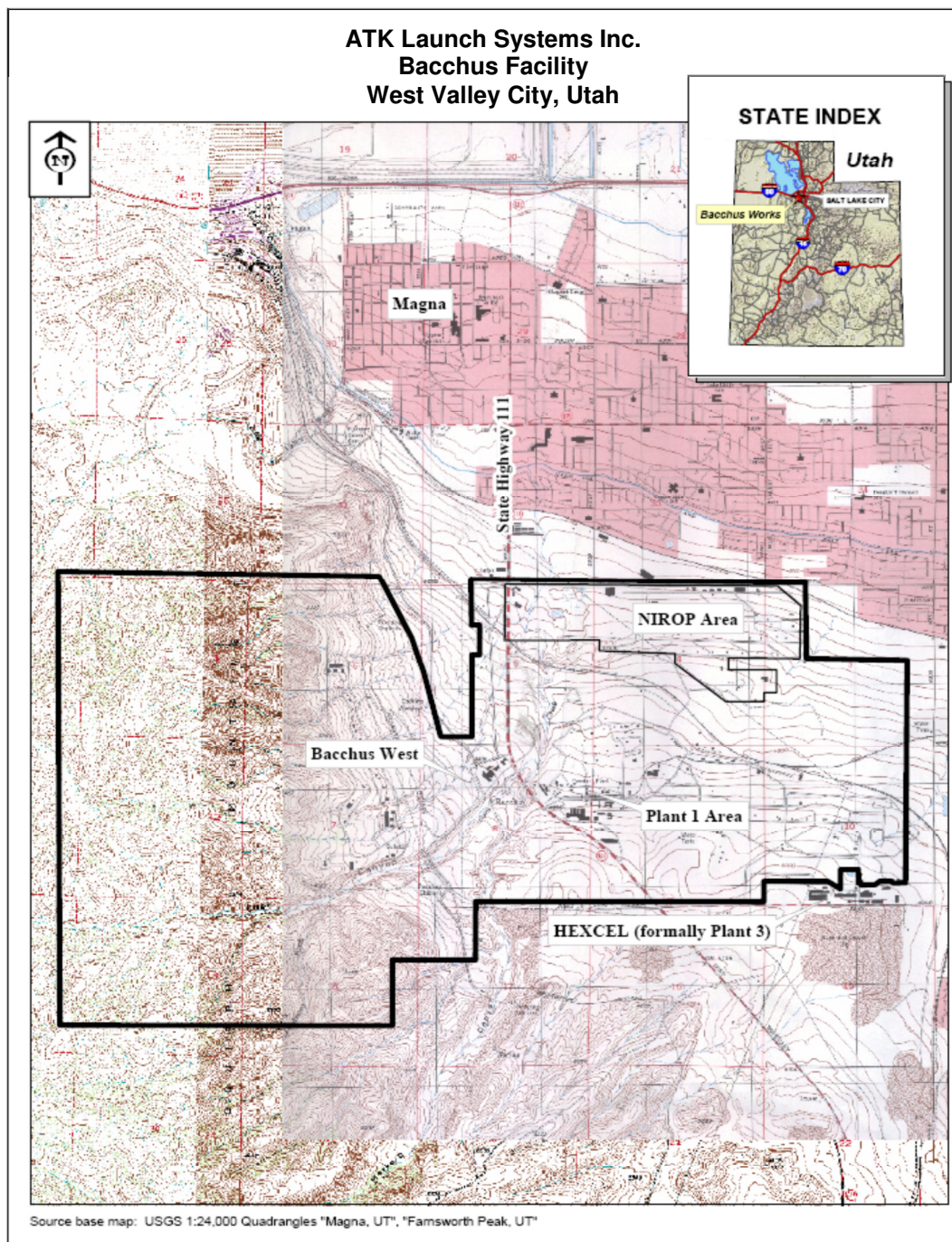


Figure 1 – ATK Bacchus Location



Figure 2 –SWMU Locations

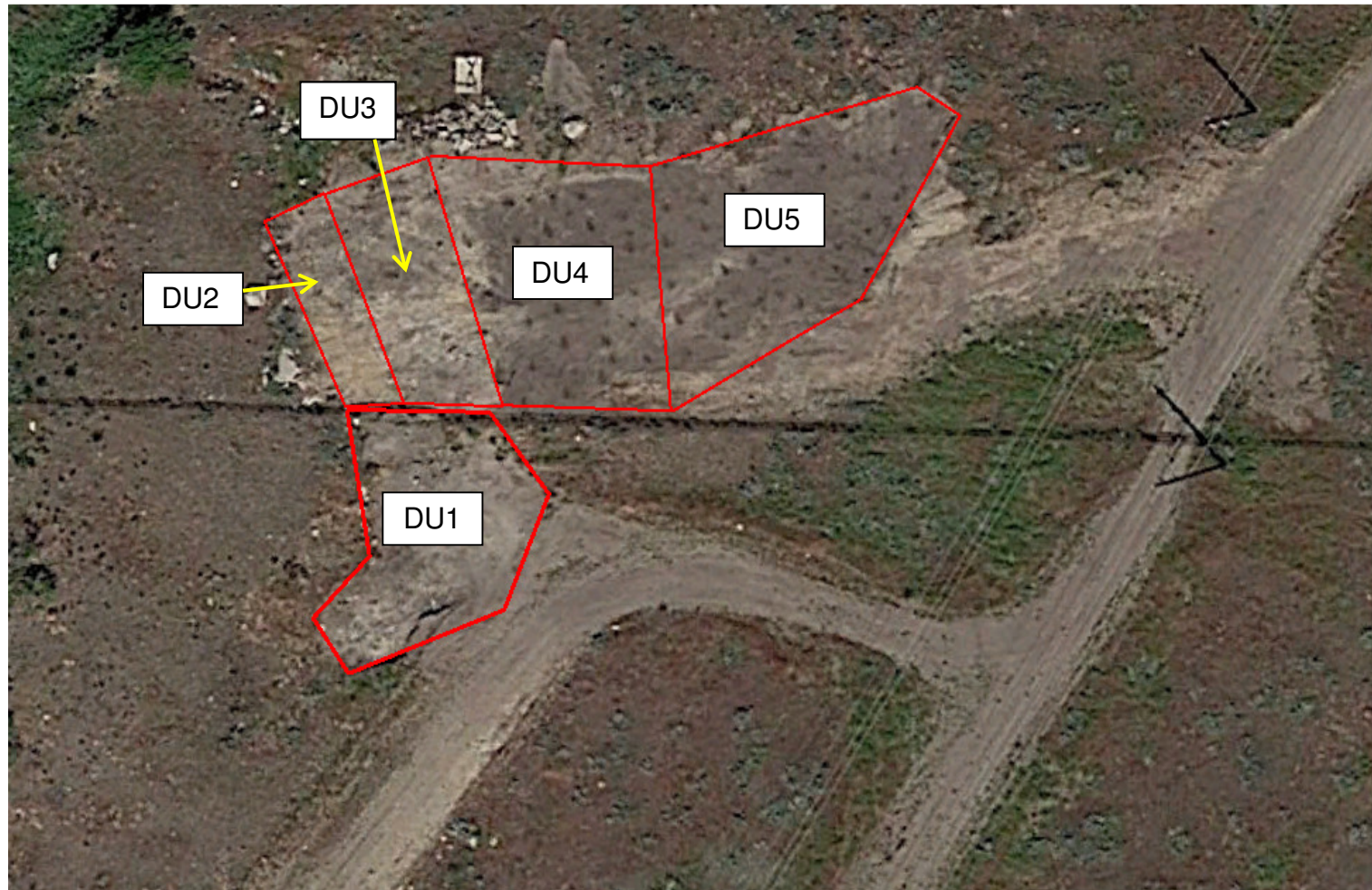


Figure 3 – HWMU BW7, Designated Units



Tables



Attachments



Attachment A

**Photographs of
SWMUs and HWMU**



Attachment B

Bills-of-Lading



Attachment C

ISM Standard Operating Procedure



Attachment D

Chain-of-Custody
Confirmation Sample Laboratory Reports



Attachment E

RAIS Table